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(57) Abstract

A process for producing dried potato mash. According to the process the potatoes are pretreated by washing, stripping and trimming, and are then disintegrated into slices or stripes which are washed in water in order to remove free starch from the section surfaces. The slices or stripes are then blanched at a temperature within the range of 65-90°C and are cooled to each a temperature below 30°C, and are then ready-boiled in water or steam of atmospheric pressure. The ready-boiled potatoes are then strained by being pressed through a screen device having screen openings in the magnitude of 2-5mm, together constituting about 20-40 % of the total screen area. The strained potatoes are then, directly in connection with the straining operation, spread on the upper surface of a belt drier in a porous layer having a thickness of the magnitude of 15-50 mm. The potato layer is then dried to reach a moisture content of 6-8 % under the influence of a wet stream of air which is moveable in relation to the layer, and having a dry extrance temperature below 110°C and a wet entrance temperature below 85°C. The dried layer is then disintegrated into particles having a size of 2-5 mm.

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PROCESS FOR PREPARING DRIED POTATO MASH

The present invention relates to a process for preparing dried potato mash.

Dried potato mash in the form of powder or flakes is widely used in large scale households as well as in private households for simple and quick preparation of potato mash ready for consumption.

Dried potato mash has up to now been produced essentially in accordance with two known methods. One of those is the so-called add-back-process, the end product of which is referred to as potato mash powder, and the other one is the so-called roller drying process, the end product of which is referred to as potato mash flakes.

According to the first mentioned known process, the so-called add-back-process, the potatoes are boiled and then mashed. The mashed potatoes are then mixed with potato mash powder which has already been dried. The mixture thus obtained is then dried in two to four steps for reaching a moisture content of 6-8 % in the end product which consists of a fine powder. The drying operation, which is performed in several steps, is carried out at a relatively high temperature level. Drying temperatures amounting to 180-190^{o}C are thus usual. The mixing process requires 2,6-2,7 kg of already dried powder for 1 kg newly boiled mashed potatoes. The quantity end product obtained will maximally be about 0,2 kg powder per 1 kg mashed potatoes. This means that only 5,5 % finished product is obtained from the wet mixture supplied to the drying system. The powder is thus allowed to circulate within the drying system at the average a very great number of times. Theoretically more than 10 % of the original add-back-powder remains in the system after 25 cycles. The end product is referred to as potato mash powder.

According to the second one of the known processes, the so-called roller drying process, the potatoes are boiled and then mashed. The mashed potatoes are dried on a roller drier, resulting in an end product in the form of flakes having a water content of 6-8 %. Also in this process the drying operation is carried out at a relatively high temperature level, usually at a temperature corresponding to the temperature of saturated steam at a pressure of 7 bar, i.e. at about 170°C. The roller-drying process is a so-called direct process in which the product after boiling is exerted to heat treatment only once. The end product is referred to as potato mash flakes.

Both of the known processes mentioned above have in common the fact that the potato cells are exerted to great termal as well as mechanical strain. This results in that a great number of cells will burst so that free starch will be present in the product. This involves a troublesome disadvantage in that the free starch gives rise to a gluey condition of the product when this is "restored", i.e. when warm liquid is added to the powder or the flakes in order to obtain potato mash ready for consumption. The higher the temperature of the liquid thus used the more gluey the condition of the potato mash prepared. In the use of potato mash flakes it has thus been found that the finished potato mash becomes very gluey if the temperature of the liquid used for the "restoring operation" exceeds 80°C.

In order to reduce this troublesome disadvantage with the known processes it is a usual procedure to add an emulsifier, monoglyceride GMS (glycerol monostearate). Even if it is possible by this measure to reduce to a certain extent the glueness, the fact still is that potato mash powder and potato mash flakes produced according to the methods mentioned above, when being

"restored" will give rise to potato mash of a non-wanted degree of glueness.

An other troublesome disadvantage characteristic for potato mash powder and potato mash flakes produced according to methods mentioned above is that smell and taste to a too high extent have been found to diverge from so-called homecooked potato mash which has been produced from cooking potatoes of a good quality. One reason which to a considerable extent contributes to impaired smell and taste of the end product is the harsh heat treatment to which the potatoes are exerted during the drying operation as well in the so-called add-back-process as in the so-called roller drying process. Another reason which contributes to impaired taste of the end product is the different additives which for different reasons are added during the production process, e.g. the emulsifier added in order to decrease the ability of glueness, and different kinds of antioxidizing agents which are added in order to protect the product as well during the drying process as later during storing, and which may consist of one or several of SO_2, BHA, BHT and a herb extract referred to as AR.

The concurrent factors specified above have so far resulted in that potato mash powder and potato mash flakes produced by the known processes mentioned above are impaired by troublesome disadvantages with respect to consistency as well as relating to smell and taste of the ready-prepared patato mash.

The object of the present invention is to provide a process whichs renders possible mass production of dried potato mash which does not have the disadvantages mentioned above, and in which the need of additives is eliminated or decreased to a great extent, and which renders possible the restoration at a higher temperature than what is possible with the known products

without risk for glueness, and in which consistency as well as smell and taste of the ready-prepared potato mash very closely resembles with the consistency, taste and smell of "home-made" potato mash. Still an object of the invention is to provide a process which involves a lenient treatment of the raw material as well from mechanical as from termal point of view and which is energy-saving.

The objects specified above are obtained by a process having the characteristic features specified in the appended claims.

The process according to the invention will be explained in greater detail in the following by an exemplifying description, describing step by step the measures to be taken for carrying out the process according to the invention.

The measure first to be taken when the process according to the invention shall be carried out is to have the quantity of potatoes which shall be treated, washed, inspected, stripped and trimmed, i.e. have the potatoes treated by cutting away parts on separate potatoes that may be defective, said operation being carried out in a conventional manner. The quantity of potatoes thus stripped and trimmed is then disintegrated into slices or strips by using a conventional cutting machine. The slices or strips are then washed in water in order to remove the starch which has been detached on the surfaces during the cutting operation. The sliced or stripped and washed potatoes are then blanched, i.e. are subjected to heat treatment in water or steam, at a temperature of 65-90^{o}C during 10-20 minutes. The blanching is usually carried out at a temperature of 75-80^{o}C during a time of 15 minutes.

After the blanching operation the potatoes are cooled to a temperature below 30^{o}C. The cooling operation can

be carried out by means of water or by using a combination of air and water, the cooling time amounting to 10-20 minutes. Cooling of the potatoes to 22-25°C and a cooling time of about 15 minutes are values that are commonly used.

When the cooling operation has been carried out the potatoes are transferred to a steam boiler in which the potatoes are ready-cooked in saturated air under atmospheric pressure. The time required for the ready-boiling varies depending on variety of potatoes, dry content, season and the dimensions of the slices or strips into which the potatoes have been disintegrated. As an example it may be mentioned that Bintje potatoes have been ready-boiled by using a boiling time between 18-30 minutes.

The steps of treatment described so far correspond to the steps of treatment used also in the initially described processes for producing potato mash powder and potato mash flakes. The process according to the invention differs, however, from the processes previously known in this area by the combination of steps which will be described in more detail in the following.

When the potatoes thus in the manner described above have been ready-boiled, the potatoes are disintegrated by being strained through a screen device. The straining operation may thus be carried out by pressing the potatoes by means e.g. of a rotating cylinder through a wire mesh of plastics or from steel wire or through a perforated plate in which the dimensions of the screen plate openings range to 2-5 mm, the total area of the screen plate openings amounting to about 20-40 % of the total area of the screen surface. Said size of the screen plate openings together with the total area of the screen plate openings in relation to the screen surface has proved to result in a particle size of the passed potatoes, which advantageously contributes to the porosity of

the potatoes which is required for the continued drying operation. A screen device having a screen surface of perforated plate including screen plate openings having a diameter of 2,5 mm and a total opening area of about 30 % of the total screen surface has proved to give a good result.

The potatoes which have been ready-boiled and strained in the manner described above shall then be subjected to a drying operation, and in order to facilitate and promote this operation the strained potatoes shall, according to the invention, directly in connection with the straining operation be spread on a drying bed in a porous layer having a thickness of the magnitude of 15-50 mm, preferably a layer having a thickness of 25-35 mm. In this operation it is important that the transfer from the steam boiler via the straining machine to the drying bed in the dryer is effected with a minimum loss in temperature. For carrying out the drying operation it is preferred to use a belt drier including an endless, driven conveyor belt, the upper surface of which forming said drying bed. For rendering possible during this operation to transfer the strained potatoes at a minimum temperature loss, the end of the conveyor belt is preferably disposed directly under the straining machine, so that the strained potatoes are transferred to the upper surface of the drier belt by falling freely a distance that is as short as possible. The short fall which preferably should not exceed 150 mm, is also important in order to obtain a porous and loose layer of strained potatoes on the belt.

The spread potato layer is then dried for reaching a moisture content of 6-8 % under the influence of a wet stream of air which is moveable with respect to the layer, the temperature of said stream of air being care-

fully controlled to have a dry input temperature below 110°C and a wet input temperature below 85°C. As previously mentioned the drier preferably consists of a drier belt, wherein the belt may consist of perforated steel plate or a wire mesh made of plastics or of steel. From the aspect of cleaning and maintenance it is preferred to use belts of perforated steel plate. In a drier of this kind the drying operation is carried out by blowing heated wet air alternately from the under side and from above through the belt and the stuff to be dried.

The drier belt may also consist of a non-perforated steel belt, the drying operation being carried out by blowing heated, wet air along the belt, above as well as under the belt. In this case the temperature of the air to be blown under the belt should be 5-20°C higher than the temperature of the air to be blown on the upper side of the belt.

A careful control of the dry temperature as well as the wet temperature of the drying air is an important feature of the present invention. An appropriate control of the dry and wet temperatures of the drying air is thus one of the conditions necessary to obtain a favourable end product. According to the invention a basic condition thus is that neither the dry nor the wet temperature of the drying air should be allowed to amount to such a value that the cells are damaged resulting in leakage of free starch. As previously mentioned the temperatures have thus been maximized so that the dry temperature is kept below 110°C and the wet temperature is kept below 85°C.

According to a preferred embodiment the temperatures of the wet drying air are controlled so that the dry temperature is kept between 90°C and 110°C during the first half of the drying operation, and is then allowed to drop to 70°C during the second half. At the

same time the wet temperature should be kept between 60°C and 80°C during the first half of the drying operation, and is then allowed to drop to 50°C during the second half.

It has been found possible to obtain a favourable result also by controlling the drying air temperature so that the dry temperature is kept at 100°C - 105°C during the entire drying operation, and the wet temperature is kept at 80°C during about 60 % of the initial drying operation, and is then allowed to drop to about 70°C. In the last mentioned embodiment the thickness of the layer of potatoes was about 35 mm and the time of drying 18-20 minutes.

In all the cases the drying operation is carried through in such a way, that the moisture content after having finished the drying operation amounts to 6-8 %, and the time of drying required in order to obtain this result varies between 15 and 30 minutes. As should appear of the embodiment described above it is possible to control the temperature of the drying air in several different ways without departing from the invention. It is preferred, however, to control the dry temperature as well as the wet temperature so that said temperatures are kept somewhat lower at the end than at the start of the drying operation, which i.a. also involves advantages from the aspect of energy saving.

When the dry product leaves the drier it consists of a porpous cake which rather easily may be disintegrated. The disintegrating operation is advantageously carried out in a so called finger mill or between two rolls, or in a combination of both. The piece size of the disintegrated product should be between 2-5 mm.

The process according to the invention is particularly advantageous thanks to the fact that the mechanical as well as the termal action to which the product

is subjected during the process is mild, which results in that no cells or a very small number of cells are damaged so that it causes leakage of free starch. The relatively low dry temperature combined with the high wet temperature results in that the product is surrounded by a mixture of steam and air, which in turn results in a low susceptability to oxidation during the drying operation. At the same time an advantage is obtained in that colour, taste and smell are affected to a considerably lower extent than is the case in the processes previously known. The mild treatment to which the product thus is subjected in the process according to the invention further results in the elimination of the need of emulsifier (MSG). The need of anti-oxidation additives also decreases. It is probably enough to add an extract of herbs.

The preparation of a portion of potato mash ready for consumption by using dried potato mash produced according to the invention is suitably effected by making the measured quantity of water and milk added with a knob of butter or margarine together with condiment (salt and pepper) boil in a saucepan. The measured quantity of dry product is added to the boiling liquid which is then kept boiling during additionally about 2 minutes, after which the saucepan is removed from the source of heat. Ater 3-5 minutes the liquid has been absorbed by the product and the potato mash thus obtained is ready to be served.

Still another advantage of the process according to the invention thus is, that the product can be restored in boiling water, which means a high serving temperature. In spite of the fact that the product is restored in boiling water it does not become gluey. With respect to taste, colour and consistency, potato mash prepared by using the product obtained according

to the invention becomes very similar to "home-cooked" potato mash.

CLAIMS

1. Process for production of dried potato mash in which the potatoes, after pretreatment by washing, stripping and trimming that might be necessary, are disintegrated into slices or strips, which are then washed in water to remove free starch from the section surfaces, after which the slices or strips thus treated are blanched at a temperature within the range of 65-90°C, cooled to a temperature below 30°C and then are ready-boiled in water or steam at atmospheric pressure c h a r a c t e r i z e d in

- that the ready-boiled potatoes are disintegrated by being strained through a screen device,
- that the strained potatoes directly in connection to the straining operation are spread on a drying bed in a porous layer having a thickness of the magnitude 15-50 mm, preferably 25-35 mm,
- that the spread potato layer is dried to reach a moisture content of 6-8 % under the influence of a wet stream of air which is moveable with respect to the layer and having a dry starting temperature below 110°C and a wet starting temperature below 85°C and
- that the dried layer then is disintegrated into a particle size of the magnitude 2-5 mm.

2. Process according to claim 1 c h a r a c t e r i z e d in that the ready-boiled potatoes are strained by being pressed through a screen device having screen openings being sized about 2-5 mm, together representing about 20-40 % of the total screen area.

3. Process according to claim 1 or claim 2 c h a r a c t e r i z e d in that the ready-boiled potatoes are strained by being pressed through a screen device having screen openings with a diameter of about 2,5 mm, the total area of which constituting about 30 % of the

total screen area.

4. Process according to any of claims 1 - 3 c h a r a c t e r i z e d in that the strained potatoes directly after the completion of the straining operation are spread on the surface of a propelled conveyer belt included in a drying device, in a layer having the thickness mentioned.

5. Process according to claim 4 c h a r a c t e r i z e d in that the strained potatoes are transferred to said conveyor belt by falling freely, the height of fall being less than about 150 mm.

6. Process according to any of claims 1 - 5 c h a r a c t e r i z e d in that the temperature of the drying air is controlled so that at least its wet temperature is lower at the exit end of the drier than at its entrance end.

7. Process according to any of claims 1 - 6 c h a r a c t e r i z e d in that the temperature of the drying air is controlled so that its wet temperature as well as its dry temperature is lower at the exit end of the drier than at its entrance end.

8. Process according to any of claims 1 - 7 c h a r a c t e r i z e d in that the temperature of the drying air is controlled so that the dry temperature during the first half of the drying operation is kept between 90°C and 110°C, and than successively is allowed to decrease to about 70°C, and that the wet temperature is kept within the limits 60°C-85°C during the first half of the drying operation and then is allowed to sink to about 50°C.

9. Process according to any of claims 1 - 6 c h a r a c t e r i z e d in that the temperature of the drying air is controlled so that the dry temperature during the entire drying operation is kept within the limits 100°C-105°C, and its wet temperature is kept at about 80°C

during about 60 % of the drying operation and is then allowed to sink to about 70°C.

INTERNATIONAL SEARCH REPORT

International Application No PCT/SE85/00015

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC 4

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II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC 3	A 23 L 1/216
IPC 1	A 23 1 1/12
US Cl	426:102, 443, 637

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

SE, NO, DK, FI classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
A	SE, B, 306 001 (CANADIAN PATENTS AND DEVELOPMENT LTD) 1 July 1968	1
A	Derwent's abstract No 18 863 D/11, SU 736 942 30 May 1980	1
A	DE, A1, 1 792 174 (PFANNI-WERK OTTO ECKART KG) 14 October 1971	1, 4
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IV. CERTIFICATION

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